

Remarks

Status of the Claims

Applicants appreciate the thorough examination of the application as evidenced by the Office Action of March 23, 2006 (the "Action"). In response, Applicants acknowledge the election of Claims 1-15 and note that Claims 16-30 have been withdrawn from consideration as being drawn to a nonelected invention. Claim 1 has been amended to incorporate the subject matter of Claim 2, and Claim 2 has been canceled. Claim 5 has been rewritten in independent form. Claim 2 and Claim 5 were rejected in the Action under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent Publication No. 2004/0009678 to Asai ("Asai"). Claims 31-32 are newly added.

Applicants hereby request further consideration of the application in view of the amendments above and the comments that follow.

Claims 1 and 3-15 are patentable over Saeki

Claim 1 recites a metal deposition processing apparatus including:

a first processing chamber configured for holding a semiconductor substrate therein;

a second processing chamber configured for holding the semiconductor substrate therein and forming an upper metal layer thereon, wherein the first processing chamber is configured for forming a barrier metal layer on the semiconductor substrate, and the second processing chamber is configured for forming the upper metal layer on at least a portion of the barrier metal layer on the semiconductor substrate; and

a transfer chamber isolated from an oxygen atmosphere and connected to the first processing chamber and the second processing chamber, the transfer chamber configured to transfer the semiconductor substrate between the first processing chamber and the second processing chamber.

Claim 5 recites a metal deposition processing apparatus, wherein:

the first processing chamber is configured for flushing a barrier metal layer on the semiconductor substrate, and the second processing chamber is configured for forming the upper metal layer on at least a portion of the barrier metal layer on the semiconductor substrate.

With respect to the above underlined recitations, the Action states that Asai teaches that the apparatus can be used for the recited intended method. In addition, the Action takes the position that Claims 1-15 include "numerous intended use recitations" and takes the position that "'the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus' if the prior art apparatus teaches all the structural limitations of the claim." The Action, page 3 (citing Ex parte Masham, 2 USPQ2d 1647 (BPAI 1987)).

Applicants submit that Asai does not teach all of the structural limitations of the claims as maintained in the Action. **Figure 7** of Asai proposes a transfer chamber **40** including a transfer robot **41**, a load-lock chamber **42**, a reaction chamber **43** for performing a surface treatments (such as RCA cleaning), a second reaction chamber **44** for forming an HfO₂ film (such as the CVD chamber in **Figure 1**) and a third reaction chamber **45** for forming an electrode on the film. As Applicants understand page 3 of the Action, the Action identifies the second reaction chamber **44** (also shown as the CVD chamber of **Figure 1**) as equivalent to the first processing chamber as recited in Claims 1 and 5 and the third reaction chamber **45** as equivalent to the second processing chamber as recited in Claims 1 and 5.

The CVD apparatus of Asai is not configured to form a barrier metal layer or to flush a barrier metal layer as recited in Claims 1 and 5, respectively. **Figure 1** of Asai illustrates a CVD apparatus that is configured to form an insulation layer, and more specifically, a HfO₂ film. Asai, paragraph 77 and 183. The CVD apparatus of **Figure 1** includes an inert gas supply unit **10** and a film formation raw material supply unit **9**. The film formation raw material supply unit **9** includes an organic material such as Hf-(MMP)₄ which is supplied to the chamber. The mixed gases are used to form the HfO₂ film as an insulation layer on the substrate. Asai, paragraphs 90-91. The mixed gases included in the CVD apparatus of Asai are for forming an insulation layer, and as such, are not suitable for forming a barrier metal layer as recited in Claim 1 or for flushing a barrier metal layer as recited in Claim 5.

In addition, the processing chamber of Asai includes a remote plasma unit **11** that includes an oxygen supply unit 7 for supplying oxygen or oxygen-containing gas to the chamber as part of a film-modifying step to remove impurities. Asai, paragraphs 83, 92. In contrast to the HfO₂ films of Asai, the current specification discusses that oxygen

contamination of barrier metal layers can result in increased resistivity, and therefore, it is desirable to decrease oxygen contamination. Specification, page 12, lines 1-6 and page 2, lines 31-32. Therefore, the CVD apparatus of Asai teaches away from an apparatus that is configured to form a barrier metal layer as recited in Claim 1 or configured to flush a barrier metal layer as recited in Claim 5.

For at least these reasons, Claims 1 and 5 are patentable over the cited references. Claims 3-4, 9-15 and 31 depend from Claim 1 and Claims 6-8 and 32 depend from Claim 5 and are patentable at least per the patentability of Claims 1 and 5. Moreover, certain dependent claims are separately patentable for at least the reasons that follow.

Claims 7, 31 and 32 are Separately Patentable.

Claim 7 recites "the flushing gas supply conduit includes a flushing gas selected from the group consisting of gases containing a halogen group element and gases containing a halogen group element and a transition metal." As discussed above, Asai proposes a film formation raw material supply unit 9 that includes an organic material such as $\text{Hf}(\text{MMP})_4$ (for forming an insulating layer) and an oxygen supply unit 7 for supplying oxygen or oxygen-containing gas (for removing impurities from the insulating layer). Asai does not teach or suggest a flushing gas selected from the group consisting of gases containing a halogen group element and gases containing a halogen group element and a transition metal as recited in Claim 7. Applicants submit that Claim 7 is patentable at least for the reasons discussed above and request an indication of same.

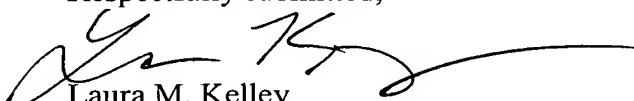
Claim 31 recites "a controller configured to control a gas supply conduit to form the barrier metal layer on the semiconductor substrate in the first processing chamber." Support for Claim 31 can be found on page 7, lines 2-4. Claim 32 recites "a controller configured to control a flushing gas to flush the barrier metal layer in the first processing chamber." Support for Claim 32 can be found on page 10, lines 1-19. Asai proposes a CVD chamber for forming and modifying an insulating layer. Asai does not teach or suggest a controller configured to control a gas supply conduit to form the barrier metal layer or a controller configured to control a gas supply conduit to flush the barrier metal layer as recited in Claims 31 and 32, respectively.

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Conclusion

For at least the above reasons, Applicants submit that all pending claims are in condition for allowance. Should the Examiner have any matters outstanding of resolution, he is encouraged to telephone the undersigned at 919-854-1400 for expeditious handling.

Respectfully submitted,



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